Claims

1. A reactor for the plasma assisted processing of a gaseous medium including a pair of electrodes (1,2;21,22) having facing surfaces, the separation of the facing surfaces being substantially uniform and defining a space therebetween, a body (5;23) of dielectric material positioned to provide a dielectric barrier between the electrodes (1,2;21,22) and configured to divide the said space between the electrodes (1,2;21,22) into a plurality of gas passages (6;24), which together provide the plasma volume of the reactor and along the lengths of which gas flows in use of the reactor, the gas passages (6;24) being aligned so that their lengths extend between and in a direction parallel with the facing surfaces of the electrodes (1,2;21,22), the gas passages being spaced apart from one another in a direction transverse to the said facing surfaces, characterised in that the gas passages (6;24) are shaped so as to have a pair of opposed sides the contour of which matches the contour of the said facing surfaces of the electrodes (1,2;21,22), this shape and the spacing of the gas passages being such that a substantially uniform distribution of electric field occurs across the plasma volume space between the electrodes (1,2;21,22).

2. A reactor according to claim 1, further characterised in that the electrodes (1,2;21,22) are embedded in a body (5;23) of dielectric material which extends across the space between the electrodes (1,2;21,22) and includes a plurality of gas passages (6;24) extending longitudinally of the body (5;23) of dielectric material to provide a plurality of electrically equivalent plasma volumes extending in series across the space between the electrodes

3. A reactor according to claim 1 or claim 2, further characterised in that the dielectric material is selected from the group consisting of alpha or gamma aluminas, cordierite, mullite, alumino silicate ceramics, silicon carbide, micaceous glass or mixtures of these.

4. A reactor according to claim 1 or claim 2 or claim 3, further characterised in that the gas passages (6;24)

are adapted to present a catalytically active surface to gaseous medium passing through them.

5. A reactor according to claim 4, further characterised in that the surfaces of the gas passages (6;24) are coated, impregnated or treated by ion-exchange or doping, with a catalytically-active material.

6. A reactor according to claim 4 or claim 5, further characterised in that that the catalytically active surface is catalytically active towards the reduction of the emissions of one or more of nitrogenous oxides, particulate including carbonaceous particulate, hydrocarbons including polyaromatic hydrocarbons, carbon monoxide and other regulated or unregulated combustion products from the exhausts of internal combustion engines.

7. A reactor according to claim 4 or claim 5 or claim 6, further characterised in that the catalytically-active material is selected from the group comprising alpha and gamma aluminas and mixtures of these phases, ferroelectric materials such as titanates, including barium titanate, titania, including anatase phase titania, zirconia, vanadia, silver aluminate, perovskites including layered perovskites and La_2CuO_4, $La_{1.9}K_{0.1}Cu_{0.95}V_{0.05}O_4$ and $La_{0.9}K_{0.1}CoO_3$, spinels, metal-doped and metal oxide-doped or exchanged inorganic oxides including cobalt oxide-doped alumina, vanadates including potassium metavanadate, caesium metavanadate, pyrovanadates including potassium pyrovanadate and caesium pyrovanadate, metal-doped zeolites including zeolites known as ZSM-5, Y, beta, mordenite all of which zeolites may contain iron, cobalt or copper with or without additional catalyst promoting cations such as

cerium and lanthanum, alkali metal containing zeolites in particular sodium-Y zeolites and mixtures of any of these materials.

8. A reactor according to any of the preceding claims, further characterised in that the gas passages(6;24) contain a gas permeable body of an insulating filling material.

9. A reactor according to claim 8, further characterised in that the insulating filling material comprises a dielectric material.

10. A reactor according to claim 9, further characterised in that the dielectric material is a catalytically active material.

11. A reactor according to claim 9 or claim 10, further characterised in that the dielectric material is coated, impregnated or otherwise treated with a catalytically active material.

12. A reactor according to claim 9, further characterised in that the dielectric material develops catalytically active properties by virtue of exposure to plasma in the gas passages(6;24).

13. A reactor according to any of the preceding claims, further characterised in that the electrodes(1,2;21,22) are planar and the gas passages(6;24) have a generally rectangular cross-section with their major transverse dimensions parallel to those of the said facing surfaces of the electrodes(1,2;21,22).

14. A reactor according to any of claims 1 to 12, further characterised in that the electrodes(21,22) are

~~in the form of two concentric cylinders and the gas passages(24) comprise a plurality of regularly spaced slots of cylindrical form.~~

15. A reactor according to any of the preceding claims, further characterised in that the arrangement of gas passages (6,24) is such that the potential drop across the plasma volume between the electrodes is equal to approximately half the voltage applied to the reactor.

16. A reactor according to any of the preceding claims, further characterised in that power supply for the reactor is provided by an integrated starter alternator damper system.

17. A reactor according to any of claims 1 to 15, further characterised in that fuel cells, gas turbines, solar cells or heat exchangers are used as primary or part-provider of an electrical-generating power supply for the reactor.

18. A reactor according to any of the preceding claims incorporated as part of an emissions control system.

19. A reactor according to claim 18, further characterised in that the emissions control system is used in conjunction with an engine management system.

20. A reactor according to claim 18 or claim 19, further characterised in that the emissions control system includes an additional gas passage outside of the plasma region of the reactor in series with the aforesaid gas passages(6,24), said additional gas passage containing gas permeable catalytically active material.

21. A reactor according to claim 20, further characterised in that the catalytically active material in the said additional gas passage comprises a dielectric material.

22. A reactor according to claim 20, further characterised in that the catalytically active material in the said additional gas passage comprises a polymeric or metallic material.

23. A reactor according to any of claims 20, 21 or 22, further characterised in that the gas permeable catalytically active material in the said additional gas passage is in the form of spheres, pellets, extrudates, fibres, sheets, wafers, frits, meshes, coils, foams, membrane, ceramic honeycomb monolith or granules or as a coating on a ceramic foam or ceramic honeycomb monolith.

24. A method of plasma assisted processing of a gaseous medium using a reactor according to any of the preceding claims, characterised in that a reductant for the treatment of nitrogeneous oxides is supplied to the said gas passages(6,24) or said additional gas passage.

25. A method according to claim 24, further characterised in that the reductant comprises a hydrocarbon or a nitrogen containing compound.

26. A method according to claim 25, further characterised in that the reductant comprises hydrocarbon residually derived from fuel combustion.

27. A method according to claim 25, further characterised in that the reductant comprises a nitrogen containing compound selected from ammonia, urea or cyanuric acid.

Add A1